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| 10/773,186 | 02/09/2004 | Kia Silverbrook | MTB25US | 8433 |

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| EXAMINER | |
|---|---|
| FIDLER, SHELBY LEE | |
| **ART UNIT** | **PAPER NUMBER** |
| 2861 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/773,186 | SILVERBROOK, KIA | |
| | Examiner | Art Unit | |
| | Shelby Fidler | 2861 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *22 October 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1,3,5,6,8,10-19,21,24,25,27,29-38,40,42-44 and 46-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,5,6,8,10-19,21,24,25,27,29-38,40,42-44 and 46-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/22/2007 has been entered.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 5, 11-13, 19, 21, 24, 30-32, 38, 40, 42, 47, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 4870433) in view of Lichtenberger et al. (US 4801947).

**Regarding claims 1, 19, and 38:**

**Campbell et al. disclose** an inkjet printhead comprising:

a plurality of nozzles (nozzles 19; col. 3, lines 1-3 and col. 2, lines 17-21);

a bubble forming chamber (print cavity 21) corresponding to each of the nozzles respectively (Fig. 2);

at least one heater element (resistive heater elements 12) disposed in each of the bubble forming chambers respectively (Fig. 2), the heater element configured for thermal contact with a bubble forming liquid (ink; col. 3, lines 8-11); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (bubble 22) that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 8-13); wherein,

the heater element has at least one bubble nucleation section (elongated portions 31), each bubble nucleation section (31) having a smaller cross section than the remainder of the heater element (Figs. 2 and 3; as compared to end portions 32);

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to the cyclic ejections of col. 3, lines 3-7 and col. 4, lines 64-68); and

wherein the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64).

**Campbell et al. do not expressly disclose** a projecting nozzle rim formed about each of the nozzles respectively, each nozzle rim being configured to direct the drops ejected from the respective nozzle in a particular direction.

**However, Lichtenberger et al. disclose** a projecting nozzle rim (e.g. rim 58 projects outwardly in Fig. 2) formed about each of a plurality of nozzles (orifice 52) respectively (Figs. 2-3), each nozzle rim being configured to direct the drops ejected from the respective nozzle in a particular direction (col. 4, lines 27-33).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a projecting nozzle rim, such as disclosed by Lichtenberger et al., into

the invention of Campbell et al. The motivation for doing so, as taught by Lichtenberger et al., is to be able to eject each droplet in parallel relationship to other droplet streams to promote high quality printing (col. 4, lines 27-33).

**Regarding claims 3, 21, and 40:**

**Campbell et al. also disclose** that the bubble forming chamber (21) has a circular cross section (Fig. 1) and the heater element (12) has sections that are concentric with the circular cross section (Figs. 1-3).

**Regarding claims 5, 24, and 42:**

**Campbell et al. also disclose** that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 3, lines 8-13).

**Regarding claims 11, 30, and 47:**

**Campbell et al. also disclose** that the heater elements (12) have two opposite sides (e.g. the sides relating to the top of Fig. 3 and bottom of Fig. 3) and are configured such that the gas bubble (22) formed by the heater elements are formed at both of the sides of the heater elements (col. 3, lines 50-60).

**Regarding claims 12, 31, and 48:**

**Campbell et al. also disclose** that the bubble (20), which each heater element is configured to form, is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (col. 3, lines 60-66).

**Regarding claims 13 and 32:**

**Campbell et al. also disclose** a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Examiner notes the limitation that the structure is formed by chemical vapor deposition. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself; therefore, Examiner has not given this limitation patentable weight.

Claims 15, 18, 34, 37, 51, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lichtenberger et al., as applied to claims 1, 19, and 38 above, and further in view of Kubby (US 5851412).

**Regarding claims 15, 34, and 51:**

**Campbell et al. also disclose** a plurality of bubble forming chambers (21) each corresponding to a respective nozzle (Fig. 2).

**Campbell et al. as modified by Lichtenberger et al. do not expressly disclose** that a plurality of the heater elements are disposed within a bubble forming chamber, the heater elements within each chamber being formed on different respective layers to one another.

**However, Kubby discloses** a plurality of heater elements (doped regions 20a and 20b) disposed within a bubble forming chamber (Figs. 4 and 5), the heater elements within each chamber being formed on different respective layers to one another (Fig. 4).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements disposed on different layers, such as disclosed by Kubby, into the invention of Campbell et al. as modified by Lichtenberger et al.

One motivation for doing so, as taught by Kubby, is to be able to emit a plurality of droplets of distinct sizes (col. 5, lines 11-21).

**Regarding claims 18, 37, and 54:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the heater elements are covered by a conformal protective coating, the coating of each heater element applied substantially to all sides of the heater element such that the coating is seamless.

**However, Kubby discloses** heater elements (doped regions 20a and 20b) that are covered by a conformal protective coating (e.g. tantalum), the coating of each heater element applied substantially to all sides of the heater element such that the coating is seamless (col. 4, lines 33-44 and Fig. 4).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a protective coating applied substantially to all sides of the heater element, such as disclosed by Kubby, into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by Kubby, is to prevent corrosion of the semiconductor structures by the liquid ink (col. 4, lines 37-39).

Claims 6, 8, 10, 14, 25, 27, 29, 33, 43, 44, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lichtenberger et al., as applied to claims 1, 19, 38 above, and further in view of Silverbrook (US 6019457).

**Regarding claims 6, 25, and 43:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the printhead is a page-width printhead.

**However, Silverbrook discloses** a pagewidth printhead (head 200) configured to print on a page (col. 6, lines 7-12).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

**Regarding claims 8, 27, and 44:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the heater elements are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop.

**However, Silverbrook discloses** heater elements (heaters 120; Fig. 10) that are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (200 nJ; col. 19, lines 8-9).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements that require less than 500 nJ to heat the heater element to eject a drop into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced without affecting print speed (col. 19, lines 9-10).

**Regarding claims 10, 29, and 46:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

**However, Silverbrook discloses** a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter: $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

**Regarding claims 14, 33, and 49:**

**Campbell et al. also disclose** a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

**Campbell et al. as modified by Lichtenberger et al. do not expressly disclose** that the structure is less than 10 microns thick.

**However, Silverbrook discloses** a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure incorporating nozzles that is less than 10 microns thick into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Claims 16, 35, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lichtenberger et al., as applied to claims 1, 19, and 38 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

**Regarding claims 16, 35, and 52:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the heater elements are formed of solid material more than 90% of which is constituted by at least one periodic element having an atomic number below 50.

**However, Anagnostopoulos et al., disclose** heater elements formed of solid material more than 90% of which is constituted by at least one periodic element, having an atomic number below 50 (Ti and TiN, col. 10, lines 31-33).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements formed of Titanium and Titanium Nitride into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by Chan (US 5710070), is that the titanium/titanium nitride resistive layer provides good electro-migration performance to sustain high current density at high temperatures (col.3, lines 30-33).

Claims 17, 36, and 53 rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lichtenberger et al., as applied to claims 1, 19, and 38 above, and further in view of DeMoor et al.

**Regarding claims 17, 36, and 53:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the heater elements are configured for a mass of less than 10 nanograms to be heated to cause ejection of a drop.

**However, DeMoor et al. disclose** heater elements configured for a mass of less than 10 nanograms to be heated (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ $cm^3$, and the volume of TiN within the heater is $2.4*10^{-11}$ $cm^3$. Using the known densities of Ti = 4.54 $g/cm^3$ and TiN = 5.22 $g/cm^3$, the heater element has an entire mass of 0.14344 ng).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Campbell et al. as modified by Lichtenberger et al. The motivation for doing so, as taught by De Moor et al., is that these types of heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Claim 50 is rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lichtenberger et al., as applied to claim 38 above, and further in view of Coulman (US 6045215).

**Regarding claim 50:**

**Campbell et al. as modified by Lichtenberger et al. disclose all claimed limitations except** that the nozzles of the printhead are formed by chemical vapor deposition.

**However, Coulman discloses** a method of manufacturing printhead nozzles wherein the nozzles are formed by chemical vapor deposition (col. 15, line 56 – col. 16, line 24).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to substitute the nozzle manufacturing method of CVD, such as disclosed by Coulman, for the nozzle manufacturing method of electroplating, as disclosed by the combination of Campbell et al. as modified by Lichtenberger et al., since a substitution of one method of manufacturing for another involves only routine skill in the art.

*Response to Arguments*

Applicant's arguments filed 10/22/2007 have been fully considered but they are not persuasive. Applicant argues that Lichtenberger et al. (hereinafter "Lichtenberger") does not disclose the claim limitation of "a projecting nozzle rim formed about each of the nozzles respectively". Specifically, Applicant argues that Lichtenberger's rims are merely recesses that do not "project" from the orifice plate. While Examiner agrees that Lichtenberger's rims do not project in a direction perpendicular to the orifice plate (as in the instant invention), it is Examiner's stance that the rims do project in a direction parallel to the orifice plate. As shown in Figure 2 of Lichtenberger's disclosure, a recess (54) is formed about the orifice (52). Using the inner surface of this recess as a plane of reference, it is clear that the rims (58) project from this surface. The resulting orifice plate comprises an orifice that has a recess and a projecting nozzle

rim formed about the orifice. Therefore, Campbell et al. as modified by Lichtenberger et al. properly disclose all the claimed limitations.

*Conclusion*

All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

*Communication with the USPTO*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby S. Fidler 12/19/2007

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